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Hardware and Software Customer Satisfaction in Japan:

A Comparison of U.S. and Japanese Vendors

by

Michael Cusumano

WP 2101-88

Dec, 1988



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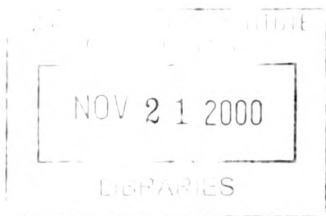
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**HARDWARE AND SOFTWARE CUSTOMER SATISFACTION IN JAPAN:  
A COMPARISON OF U.S. AND JAPANESE VENDORS**

Annual surveys of Japanese computer users by the leading industry journal, Nikkei Computer, make it possible to determine approximate market shares of the installed base of computers by placement value and number of units, as well as to evaluate responses of Japanese users to hardware, software, and system-engineering (SE) services provided by both Japanese and U.S.-owned vendors.<sup>1</sup> The Japanese market continued to be dominated by large computers, with smaller office computers accounting for approximately 23% of installed units.<sup>2</sup> It was highly competitive, with large computers alone divided among 7 firms and numerous product lines:<sup>3</sup>

Fujitsu:	M Series, VP series
Japan IBM:	43XX, 308X, 3090
Hitachi:	M Series, H-8600, H-6700, S-800
NEC:	ACOS Series, SX Series
Mitsubishi:	COSMO Series, EX Series
NCR:	V-8400-8600, I-9000, ITX/9000, NCR9800, NCRXL
Unisys	
Univac/Sperry:	1100 Series, System 11, 2200 Series, 80 Series, 90 Series
Burroughs:	B1800-7800, B1900-7900, A Series, V Series

There were also several other vendors of office computers and minicomputers, such as Toshiba and Oki Electric, and U.S. firms such as Digital Equipment Corporation, although they had small market shares.

By far the major foreign-owned computer firm was Japan IBM, which held approximately 21% of the 1988 installed base by value. The other major U.S. vendors were Unisys, with about 10% (split between Sperry-Univac and Burroughs), and NCR, with about 2% of placements by value. The foreign

computer vendors in Japan primarily marketed hardware and basic systems software designed in the U.S., modified systems to handle the Japanese language, and provided system-engineering and customized applications development services in direct competition with Japanese firms. In software development, the U.S.-owned firms generally followed guidelines set by their parents in the U.S., where appropriate, such as for modifying operating systems for the Japanese market. They also provided specialized system engineering for customers in the information service, finance, and distribution sectors, as well as those requiring system engineering and hardware for office automation and computer-aided manufacturing and design.

Japan IBM, which also did some local hardware manufacturing and assembly, had a history in Japan dating back to 1937 and was especially aggressive in selling very large computer systems and office computers, including a personal computer tailored specifically to the Japanese market. Japan Unisys included components of the former Nihon Univac, a joint venture established between Sperry-Rand and Mitsui Trading in 1951, as well as the former Japanese subsidiary of Burroughs International. It also worked closely with Oki Univac, a joint venture with Oki Electric that manufactured disk drives, printers, and terminals designed by Sperry, as well as maintained a product development center in Tokyo focused on software products. Both Unisys divisions were strong in large machines and specialized applications software. The last major U.S. player, Japan NCR, was founded in 1920 and primarily sold automated teller machines (ATMs), cash dispensers, point-of-sale registers (POS), host computers for these terminals, high priced office computers, and system-engineering services.<sup>4</sup>

The 1988 surveys of approximately 6800 Japanese users of mainframes, minicomputers, and office computers suggests that Japanese firms competed on

the basis of superior and cheaper hardware; they offered less-well perceived systems software but superior applications, and offered cheaper software and system-engineering services overall. It seems apparent that, where it matters most to customers, the leading Japanese computer manufacturers had achieved at least parity with IBM -- superiority in some areas, and inferiority in others. Specialized U.S. producers -- especially Unisys/Sperry-Univac and NCR -- were rated very highly by Japanese customers in many areas, but they accounted for very small percentages of the market. Below are some more specific observations and some of the more important tables summarizing the survey data (more details of the surveys, summarized in tabular form and referenced also in this section, are presented in Appendix C).

#### (1) Japanese Lead in Hardware Market Share

- Japanese computer manufacturers dominated their domestic market in terms of placement value (67.6%) and units (77.4), with Fujitsu holding the largest market share (32.7% and 36.0%, respectively), as of July 1988 (Table 1). IBM had a slight lead over Fujitsu in large mainframes, although Fujitsu was far ahead in mid-sized systems, while NEC led in small mainframes (Table C.1).
  
- Information services, finance, government, and distribution sectors accounted for 61% of system placements by value in the Japanese market. Four companies dominated these sectors and the industry overall: Fujitsu, IBM, Hitachi, and NEC. Japanese vendors dominated each individual industry segment, except for financial customers, where IBM was the market leader and U.S. firms held 53% of placements by value versus 47% for the Japanese. Japanese firms held 95% of the government market and

this helped their overall shares, although government placements accounted for only 13% of the total market. Minus the government sector, Japanese vendors still accounted for 63.5% of placements by value (Tables C.2 and C.3).

**Table 1: COMPUTER MARKET-SHARE COMPARISON IN JAPAN (JULY 1988)<sup>5</sup>**

Units: Million Yen, Number of Machines

<u>Maker</u>	<u>Placement Value</u>	<u>\$</u>	<u>Units</u>	<u>%</u>
Fujitsu	53,8172	32.7	2,348	36.0
Japan IBM	341,148	20.7	676	10.4
Hitachi	302,084	18.4	894	13.7
NEC	254,367	15.5	1,694	26.0
Japan Unisys	160,267	9.7	500	7.7
(Univac/Sperry)	(117,011)	(7.1)	(209)	(3.2)
(Burroughs)	(43,256)	(2.6)	(291)	(4.5)
Japan NCR	32,328	2.0	291	4.5
Mitsubishi	16,881	1.0	110	1.7
<u>Subtotals:</u>				
Japanese		67.6		77.4
U.S.		32.4		22.6
<u>Total</u>	1,645,247	100.0	6,513	100.0

## **(2) Japanese Superiority in Hardware Prices, Performance, and Maintenance**

- Japanese customers ranked Japanese computer manufacturers considerably above U.S. firms in hardware technology, price/performance (cost per million instructions per second or MIPS), and hardware maintenance. Hitachi ranked highest in these three categories among all vendors, and was closely followed by Fujitsu (Table 2).

**Table 2: USER SATISFACTION LEVELS BY MANUFACTURER (10-Point Scale)<sup>6</sup>**

Notes:

<u>Scale:</u>	<u>Points</u>
Satisfied	9 - 10
Somewhat Satisfied	7 - 8
Neither Satisfied nor Dissatisfied	4 - 6
Somewhat Dissatisfied	2 - 3
Dissatisfied	0 - 1

<u>Company Codes:</u>
F = Fujitsu
I = IBM
H = Hitachi
N = NEC
S = Unisys/Sperry-Univac
B = Unisys/Burroughs
R = NCR
M = Mitsubishi

**Bold** = Above Average  
**SE** = System Engineering

Companies	<u>F</u>	<u>I</u>	<u>H</u>	<u>N</u>	<u>S</u>	<u>B</u>	<u>R</u>	<u>M</u>	<u>Weighted Averages</u>		
									All	Japan	U.S.
System Software	6.7	7.3	6.6	6.6	7.3	7.6	6.8	6.3	6.8	6.6	7.3
Hardware	7.3	7.3	7.6	6.9	7.0	6.3	6.8	6.8	7.1	7.2	7.0
Japanese Processing	7.0	5.3	6.1	6.7	5.9	4.9	5.7	5.5	6.4	6.7	5.6
Price/ Performance	7.1	6.4	7.1	6.8	6.6	6.3	6.2	6.4	6.8	7.0	6.4
Hardware Maintenance	7.8	7.5	8.4	7.4	7.7	6.7	7.3	7.8	7.7	7.8	7.3
Software Maintenance	6.4	6.7	6.8	6.3	6.9	5.7	6.2	6.3	6.4	6.4	6.4
System SE Support	6.4	6.3	6.4	6.3	7.3	6.1	6.3	6.6	6.4	6.4	6.4
Application SE Support	6.0	5.4	6.0	6.0	6.9	5.7	6.0	5.9	5.9	6.0	5.8
Salesman Relations	6.3	6.2	6.2	6.3	6.7	6.2	6.9	6.6	6.3	6.3	6.4
Product Information	6.0	6.5	6.5	5.9	6.4	5.5	5.9	5.7	6.1	6.0	6.2
General Satisfaction	7.0	7.2	7.0	6.8	7.1	6.6	6.8	6.5	6.9	6.9	7.0

- Japanese users also cited price/performance as the most important factor influencing purchasing decisions (Table C.4). IBM was actually the price leader, although it achieved this on average by selling mostly very large systems, where prices per processing power tended to decline. Overall, however, the average price paid by users per MIP was 580,000 yen (about \$4600) for Japanese machines, compared to 730,000 yen (about \$5800) from U.S. vendors (Table 3).

### (3) U.S. Advantage In Systems Software, Marketing, and General Satisfaction

- U.S. vendors, led by Unisys and IBM, had a clear advantage over Japanese firms in customer satisfaction with systems software (Table 2). Available software was also a major reason why Japanese customers chose U.S.-made hardware when they made this choice. (Part of the problem for Fujitsu and Hitachi, however -- and especially Fujitsu, which aimed at full IBM-compatibility -- was the decision in the early 1970s to follow IBM; this made it necessary for them to wait until IBM product announcements before they could complete systems software development.)
- Japanese firms remained market leaders at least in part because available software was only the fourth most frequently cited factor influencing purchasing decisions, trailing price/performance, upward compatibility, and reliability, where Japanese vendors were either superior, close, or equal to their U.S. counterparts (Table C.4).
- U.S. firms scored slightly higher in user-satisfaction for technical support for software development in "system system-engineering" (basic hardware and software configuration), and slightly higher in general satisfaction in

system and application system engineering (Tables 2, C.5, C.6).

- U.S. vendors also scored slightly better in salesman relations, product information, and general satisfaction levels, although these types of factors (specifically, salesman enthusiasm, perception of technology excellence, and reputation) had little impact on actual purchasing decisions (Tables 2, C.4, C.5, C.6).

#### **(4) Japanese Advantage In Applications Software and System Engineering**

- Japanese firms were clear leaders in Japanese-language processing as well as superior in application system-engineering support for large computer users. Japanese vendors were especially strong in knowledge of the applications. Unisys/Sperry-Univac and Mitsubishi were best perceived in two surveys of system-engineering in applications, although both had small market shares. IBM was somewhat weak in both areas, especially applications, while Fujitsu and NEC were especially strong in Japanese-language processing (Tables 2, C.5, C.6).

#### **(5) Parity or Near-Parity in Other Software-Related Areas**

- In system system-engineering support, software maintenance, and system-software version-up support, Japanese and U.S. vendors had identical customer satisfaction scores (Tables 2, C.5, C.6).

#### **(6) Lower Japanese Prices for Software and Support Services**

- IBM charged the highest prices for its software, based on average monthly payments for leased programs such as operating systems or standard applications. Even adjusting for the price-performance levels of its

hardware, IBM still charged more than twice as much as any other vendor for its software. Overall, the average Japanese monthly charge was 1,220,000 yen (about \$10,000), compared to 2,190,000 yen (\$18,000) for U.S. vendors (Table 3).

**Table 3: AVERAGE SYSTEM CONFIGURATION AND SOFTWARE PRICES<sup>7</sup>**

NOTES: MIPS = Million Instructions Per Second  
 Price = In Million Yen (Discounted)  
 Price/Performance = Million Yen/MIP (Discounted Price)  
 Software = Monthly Charge in Units of 10,000 Yen  
 Ratio = Software Charge/Price-Performance

	HARDWARE			SOFTWARE	
	MIPS	Price	Price/ Performance	Software Charges	Ratio
Japan IBM	9.07	443	49	351	7.2
Hitachi	4.04	208	51	141	2.8
Unisys/Sperry	4.23	399	94	187	2.0
Fujitsu	2.90	157	54	140	2.6
NEC	1.55	105	68	82	1.2
Unisys/Burroughs	1.45	117	81	60	0.7
Mitsubishi	1.45	98	68	181	2.7
Japan NCR	0.85	88	103	96	0.9
<b>Weighted Averages:</b>					
Japan	2.62	147	58	122	2.2
U.S.	5.23	301	73	219	3.9

-- In system-engineering service charges, the average Japanese price per man-month on a fixed contract was 730,000 yen (\$6100), compared to 930,000 yen (\$7800) for U.S. vendors (although U.S. vendors offered more service without charge, and charged slightly less at discounted prices) (Table 4). For individually reported phases, users of Japanese vendors paid less for system consulting, system design, programming, operations, and training (Table C.7). These differences existed despite a different mix in



market shares of the vendors, although the range of system-engineering charges varied relatively little by industry segment, except in system consulting (Table C.8).

**Table 4: SYSTEM SE SERVICE CHARGES<sup>3</sup>**

Units: % of Service Provided Free of Charge  
10,000 Yen Per Man-Month

	Service Fee Gratis (%)	Average SE Charges	
		Fixed Contract	Discounted
<b>Weighted Averages:</b>			
Japanese	65 %	73 Yen	67 Yen
U.S.	74	93	65
Toshiba	87	--	--
IBM	82	107	60
NEC	71	93	69
Unisys/Burroughs	68	56	60
Hitachi	65	60	68
Unisys/Sperry	64	82	94
Mitsubishi	62	--	80
Fujitsu	60	66	65
Oki	50	--	--
NCR	41	73	58
Other	46		

#### **(7) Japanese Weakness in Office-Computers**

-- Perhaps as a result of the small size and relative newness of this segment, Japanese computer manufacturers were weakest in software development and system engineering for office computers. Toshiba and Mitsubishi were rated relatively well in office-computer system engineering, although they had very small market shares. (Nor did the Japanese firms, except for Toshiba, utilize software-factory tools for office-computer software.)

- The effect of this apparent neglect was that IBM, Unisys, and NCR were leaders in the Japanese market in both systems and applications system engineering for office computers (Table C.9, C.10). This was despite the fact that Hitachi had the largest placement share in office computers in a survey of 1600 users.<sup>9</sup> NEC was also the leader in personal computers sold in Japan, with approximately 60% of the domestic market during the mid-1980s.<sup>10</sup>

#### (7) Continued Shortage of Personnel and Reliance on Manufacturers

- Despite efforts made to train and support software personnel, more than 80% of the firms responding to the March 1988 Nikkei Computer survey reported a shortage of software personnel in system design and programming. In system design, 37% of firms reported they were "extremely short" (C.11)
- Partially as a result of this personnel shortage, users relied heavily on computer manufacturers for general system-engineering support, averaging nearly 88% for the U.S.-based firms' users, and 68% for the Japanese vendors' users. Dealers were relied on more heavily by customers of the Japanese vendors (18.5% compared to 7%) (Table C.12).
- In applications development, between 25% and 50% of the users responding claimed that they relied on outside personnel, most notably for programming. In system planning, they relied mainly on the computer manufacturers, although in other phases, from system design through maintenance, they relied most heavily on software houses, followed by the

manufacturers and then dealers (C.13).

- Japanese customers were not, however, equally satisfied with the services of dealers and software houses compared with the computer makers. This appears to reflect the severe shortage of skilled software personnel in Japan, especially outside of the major computer companies (C.14).

## APPENDIX C

### JAPANESE CUSTOMER SURVEY DATA

Table C.1: PLACEMENT-VALUE MARKET SHARES BY SYSTEM SIZE<sup>11</sup>

Note: Systems (including peripherals) were divided as follows: "large" were those costing 500 million yen and above (\$4 million @ \$1.00 = 125 yen); "mid-size" from 100 million yen (\$800,000) to 500 million; and "small" below 100 million yen.

Unit: %

	<u>Large</u>	<u>Mid-Size</u>	<u>Small</u>
Fujitsu	28.3	38.2	38.7
Japan IBM	29.8	11.8	1.8
Hitachi	22.0	15.9	7.0
NEC	7.5	21.2	38.9
Japan Unisys	10.9	7.7	10.0
Japan NCR	1.2	2.7	3.6
Mitsubishi	0.3	2.5	--
<u>Subtotals:</u>			
Japanese	58.1	77.8	84.6
U.S.	41.9	22.2	15.4
<u>Total</u>	100.0	100.0	100.0
<u>System Size</u>	55.8	33.5	10.7

**Table C.2: PLACEMENT VALUE OF SYSTEMS BY INDUSTRY:<sup>12</sup>**  
**MANUFACTURER MARKET SHARES**

Computer-Maker Codes:

F = Fujitsu	S = Unisys/Sperry-Univac
I = IBM	B = Unisys/Burroughs
H = Hitachi	R = NCR
N = NEC	M = Mitsubishi

Unit: %

Note: Totals may not add up to 100% due to rounding.

100% = 1,645 Billion Yen

Companies:	F	I	H	N	S	B	R	M	Japan	U.S.
Info. Services	29	27	25	9	7	3	0	1	64	36
Finance	25	29	16	6	14	5	6	0	47	53
Government	48	3	20	26	3	0	0	1	95	5
Distribution	37	10	17	21	5	6	3	1	76	24
Machinery	22	31	23	15	4	1	3	2	62	38
Chemicals	32	25	18	13	11	1	1	0	63	37
Elec. Machines	33	33	11	17	5	0	0	2	63	37
Energy	20	22	28	16	14	0	0	1	65	35
Institutions	44	9	8	29	4	3	2	1	82	18
Construction	43	22	13	16	2	1	1	3	75	15
Foodstuffs	26	18	18	28	2	6	2	0	72	18
Services	19	8	20	37	7	7	1	2	78	12
Others	48	20	9	17	2	2	1	1	75	25
Totals	33	21	18	16	7	3	2	1	68	32

**Table C.3: MANUFACTURER PLACEMENT VALUE BREAKDOWN BY INDUSTRY<sup>13</sup>**

Units: Same as in Previous Table

Note: Total = Industry Segment as a Percent of Total Placement Value

<b>Companies:</b>	<b>F</b>	<b>I</b>	<b>H</b>	<b>N</b>	<b>S</b>	<b>B</b>	<b>R</b>	<b>M</b>	<b>Total</b>
<b>Info. Services</b>	17	24	26	11	18	19	1	23	19
<b>Finance</b>	14	25	16	7	36	34	59	5	18
<b>Government</b>	19	2	14	22	5	0	0	13	13
<b>Distribution</b>	13	6	11	16	8	24	19	13	11
<b>Machinery</b>	5	10	9	7	4	2	9	10	7
<b>Chemicals</b>	6	7	6	5	9	2	2	2	6
<b>Elec. Machinery</b>	6	9	3	6	4	1	1	11	6
<b>Energy</b>	3	4	6	4	8	0	1	2	4
<b>Institutions</b>	5	1	2	6	2	5	4	3	4
<b>Construction</b>	3	3	2	2	1	1	1	7	2
<b>Foodstuffs</b>	2	2	2	4	1	6	2	1	2
<b>Services</b>	1	1	1	3	1	3	1	2	1
<b>Others</b>	9	6	3	7	2	3	2	7	6
<b>Totals</b>	100	100	100	100	100	100	100	100	100

**Table C.4: FACTORS INFLUENCING SYSTEM SELECTION (%)<sup>14</sup>**

Unit: %

Note: Users were asked to choose the two most important factors in influencing their purchase decisions. The percentages refer to the number of responses citing each factor.

Companies:	F	I	H	N	S	B	R	M	Weighted Averages		
									All	Japan	U.S.
Price/ Performance	46	28	43	43	29	25	21	33	40	44	26
Upward Compatibility	32	33	37	27	36	49	46	29	33	31	39
Reliability, Fault Tolerance	33	41	38	27	22	22	29	24	32	32	32
Available Software	21	31	14	18	33	33	25	19	21	19	30
Boss's Orders, Business Contacts	14	11	23	19	7	6	11	30	16	18	9
System Engineer- ing Support	13	7	12	17	23	13	9	20	14	14	11
Same Industry Operating Results	13	9	5	12	10	16	14	10	11	11	12
Maintenance Service	5	4	6	7	7	5	9	3	6	6	6
Technology Excellence	3	14	2	4	6	8	1	3	4	3	9
Salesman Enthusiasm	2	0	1	3	2	8	12	4	3	2	4
Installation Conditions	2	3	1	1	1	2	2	1	2	1	2
Reputation	1	1	0	1	0	0	1	0	1	1	1
Other	5	6	5	8	10	6	5	6	6	1	1

**Table C.5: SYSTEM SE-SERVICE PROVIDED BY COMPUTER MAKERS:<sup>15</sup>  
GENERAL-PURPOSE COMPUTER USERS**

Unit: 10-Point Scale

**Questions:**

1. Explanation of New Products
2. System Software Version-Up Support
3. New System Configuration Support
4. Proposals for Solving Problems Related to Improving System Efficiency
5. Technical Support for Software Development
6. Technical Support for Machine Security
7. Promptness in Responding to Requests to Fix Defects
8. Technical Support in Communications Areas
9. Offering of Broad Information from a Neutral Standpoint
10. Businessman-Engineer Morality
11. Total Satisfaction

<b>Questions:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
<b>Weighted Averages:</b>											
<b>Total</b>	5.9	7.1	7.3	6.1	5.5	5.1	6.9	5.9	4.8	7.2	6.5
<b>Japan</b>	5.9	7.1	7.3	6.0	5.5	5.1	6.9	5.9	4.7	7.1	6.4
<b>U.S.</b>	6.2	7.1	7.4	6.3	5.6	5.3	6.9	5.9	4.9	7.4	6.6
<b>User Base:</b>											
<b>Fujitsu</b>	5.8	6.9	7.2	5.8	5.3	5.0	6.9	5.7	4.6	6.9	6.3
<b>IBM</b>	6.4	7.0	7.2	6.0	5.2	5.1	6.9	5.7	4.4	7.4	6.5
<b>NEC</b>	5.8	7.0	7.3	6.0	5.7	4.9	6.6	6.0	4.6	7.0	6.4
<b>Hitachi</b>	6.2	7.5	7.5	6.2	5.7	5.5	7.3	6.0	5.0	7.5	6.6
<b>Unisys/Burroughs</b>	5.6	6.9	7.2	6.2	5.9	5.4	6.6	5.7	5.1	7.3	6.6
<b>Unisys/Sperry</b>	6.7	8.0	8.2	7.1	6.6	6.3	7.4	7.0	6.1	7.9	7.3
<b>NCR</b>	5.1	6.6	7.0	6.3	4.9	4.6	6.2	5.3	4.7	7.1	6.1
<b>Mitsubishi</b>	4.3	6.9	7.4	6.3	5.0	4.3	6.8	5.7	4.6	7.1	6.3



**Table C.6: APPLICATIONS SE-SERVICE PROVIDED BY COMPUTER MAKER:<sup>16</sup>**  
**GENERAL-PURPOSE COMPUTER USERS**

Unit: 10-Point Scale (0-1 dissatisfied, 9-10 satisfied)

**Questions:**

1. Proposals for System Planning and Design
2. Understanding of Business Strategy
3. Knowledge Regarding the Application
4. Knowledge of Industry Trends
5. Ease of Understanding Product Documentation
6. Communication Ability
7. Application-System Development Methodology
8. Technical Support in Communications Areas
9. Businessman-Engineer Morality
10. Total Satisfaction

<b>Questions:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Weighted Averages:</b>										
<b>Total</b>	6.1	5.1	6.5	6.0	5.2	6.2	6.6	6.6	7.1	6.4
<b>Japan</b>	6.2	5.1	6.6	6.0	5.2	6.3	6.6	6.6	7.2	6.4
<b>U.S.</b>	6.0	5.1	6.1	6.1	5.2	6.2	6.6	6.7	7.1	6.5
<b>User Base:</b>										
<b>Fujitsu</b>	6.2	5.2	6.5	5.9	5.2	6.1	6.5	6.5	7.0	6.4
<b>IBM</b>	5.8	4.8	6.2	6.0	4.7	6.1	6.4	6.5	6.9	6.4
<b>NEC</b>	6.2	5.1	6.6	6.1	5.1	6.5	6.6	6.7	7.1	6.4
<b>Hitachi</b>	6.2	4.9	6.6	6.0	5.3	6.3	6.6	6.7	7.5	6.4
<b>Unisys/Burroughs</b>	5.9	5.1	5.1	5.6	5.4	5.5	6.4	6.7	6.8	6.1
<b>Unisys/Sperry</b>	6.5	5.9	6.7	6.6	6.0	7.0	7.2	7.3	7.8	7.1
<b>NCR</b>	6.8	5.4	6.7	6.4	5.6	6.3	6.6	6.8	7.2	6.7
<b>Mitsubishi</b>	6.4	5.8	7.4	6.8	6.2	8.0	7.8	7.4	7.8	7.0

**Table C.7: AVERAGE SE CHARGES REPORTED BY USERS BY PHASE<sup>17</sup>**

Units: 10,000 Yen/Man-Month, ( ) = Number of Responses

	System Consulting	System Design	Program- ming	Opera- tions	Training	System Audit
<b>Weighted Averages:</b>						
<b>Total</b>	<b>94</b> (114)	<b>77</b> (295)	<b>58</b> (376)	<b>43</b> (327)	<b>52</b> (11)	<b>84</b> (10)
<b>Japan</b>	<b>91</b> (71)	<b>75</b> (185)	<b>57</b> (239)	<b>41</b> (171)	<b>41</b> (9)	<b>58</b> (4)
<b>U.S.</b>	<b>99</b> (31)	<b>81</b> (77)	<b>61</b> (104)	<b>45</b> (93)	<b>56</b> (1)	<b>46</b> (13)
<b>Fujitsu</b>	<b>107</b> (21)	<b>75</b> (84)	<b>56</b> (113)	<b>39</b> (82)	<b>35</b> (3)	<b>73</b> (2)
<b>IBM</b>	<b>106</b> (21)	<b>85</b> (59)	<b>63</b> (69)	<b>47</b> (62)	--	<b>30</b> (10)
<b>NEC</b>	<b>95</b> (19)	<b>78</b> (52)	<b>59</b> (71)	<b>45</b> (42)	<b>40</b> (3)	<b>15</b> (1)
<b>Hitachi</b>	<b>77</b> (29)	<b>73</b> (42)	<b>59</b> (46)	<b>42</b> (42)	<b>48</b> (3)	<b>70</b> (1)
<b>Unisys/ Burroughs</b>	<b>61</b> (4)	<b>90</b> (6)	<b>67</b> (8)	<b>35</b> (7)	--	--
<b>Unisys/ Sperry</b>	<b>102</b> (5)	<b>73</b> (5)	<b>54</b> (20)	<b>44</b> (20)	<b>56</b> (1)	<b>110</b> (2)
<b>NCR</b>	<b>82</b> (1)	<b>48</b> (7)	<b>55</b> (7)	<b>46</b> (4)	--	<b>80</b> (1)
<b>Mitsubishi</b>	<b>160</b> (1)	<b>74</b> (4)	<b>55</b> (6)	<b>47</b> (4)	--	--
<b>Toshiba</b>	<b>20</b> (1)	<b>45</b> (2)	<b>27</b> (3)	--	--	--
<b>Oki</b>	--	<b>75</b> (1)	--	<b>27</b> (1)	--	--
<b>Others</b>	<b>25</b> (1)	<b>65</b> (5)	<b>54</b> (5)	<b>34</b> (4)	--	<b>125</b> (1)
<b>Computing Centers</b>	<b>113</b> (4)	<b>97</b> (3)	<b>89</b> (4)	<b>114</b> (2)	<b>150</b> (1)	<b>15</b> (1)

**Table C.8: AVERAGE SE CHARGES BY INDUSTRY<sup>18</sup>**

Unit: 10,000 Yen/Man-Month  
 ( ) = Number of Responses

	System Consulting	System Design	Program- ming	Opera- tions	Training	System Audit
<b>Average</b>	<b>94</b> (114)	<b>77</b> (295)	<b>58</b> (376)	<b>43</b> (327)	<b>52</b> (11)	<b>84</b> (10)
<b>Industry:</b>						
<b>Materials</b>	120	80	61	45	110	107
<b>Manufacturing</b>	(8)	(31)	(36)	(24)	(2)	(3)
<b>Machinery &amp; Equipment</b>	75 (10)	74 (18)	54 (33)	41 (30)	--	--
<b>Other Manufacturing</b>	87 (35)	80 (89)	58 (22)	42 (63)	37 (3)	81 (5)
<b>Distribution</b>	96 (11)	72 (35)	63 (44)	41 (41)	29 (1)	--
<b>Finance</b>	95 (20)	77 (44)	61 (50)	44 (45)	20 (1)	80 (1)
<b>Services</b>	95 (18)	74 (51)	56 (67)	46 (49)	57 (3)	30 (1)
<b>Government/ Education</b>	100 (1)	70 (1)	62 (3)	54 (4)	20 (1)	--
<b>Other</b>	109 (10)	75 (24)	59 (32)	42 (24)	--	--

**Table C.9: SYSTEM SE SERVICE PROVIDED BY COMPUTER MAKERS:<sup>19</sup>  
OFFICE-COMPUTER USERS**

Unit: 10-Point Scale

**Questions:**

1. Explanation of New Products
2. System Software Version-Up Support
3. New System Configuration Support
4. Proposals for Solving Problems Related to Improving System Efficiency
5. Technical Support for Software Development
6. Technical Support for Machine Security
7. Promptness in Responding to Requests to Fix Defects
8. Technical Support in Communications Areas
9. Offering of Broad Information from a Neutral Standpoint
10. Businessman-Engineer Morality
11. Total Satisfaction

<b>Questions:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
<b>Weighted Averages:</b>											
<b>Total</b>	5.5	6.4	6.7	5.5	5.0	4.9	6.8	5.4	4.6	7.3	6.2
<b>Japan</b>	5.1	5.6	6.3	4.9	4.6	4.4	6.2	4.9	4.2	6.9	5.8
<b>U.S.</b>	6.0	7.3	7.0	6.2	5.5	5.4	7.3	6.0	5.1	7.9	6.8
<b>User Base:</b>											
<b>Fujitsu</b>	5.1	5.9	6.5	5.2	4.8	4.6	6.3	5.0	4.3	7.0	5.8
<b>IBM</b>	6.1	7.4	7.1	6.3	5.5	5.4	7.4	6.1	5.1	8.0	6.9
<b>NEC</b>	4.7	5.1	5.4	3.8	4.1	3.7	5.7	4.4	3.6	6.4	5.4
<b>Hitachi</b>	5.7	4.7	6.9	4.4	4.7	4.1	6.3	4.1	5.4	6.6	5.7
<b>Unisys/Burroughs</b>	5.7	7.7	7.6	6.9	6.4	6.6	8.0	7.0	5.6	8.1	7.3
<b>Unisys/Sperry</b>	4.8	6.0	6.2	4.8	4.7	4.5	6.3	3.4	5.0	6.5	5.3
<b>NCR</b>	5.2	6.2	6.2	5.7	4.3	4.2	6.2	5.0	4.7	6.5	5.8
<b>Mitsubishi</b>	5.1	5.7	6.9	5.4	4.5	4.9	6.3	5.0	4.4	7.0	6.3
<b>Toshiba</b>	6.4	6.3	7.2	5.9	5.1	4.4	6.9	6.2	4.3	7.3	6.3

**Table C.10: APPLICATIONS SE SERVICE PROVIDED BY COMPUTER MAKERS:<sup>20</sup>**  
**OFFICE-COMPUTER USERS**

Unit: 10-Point Scale

**Questions:**

1. Proposals for System Planning and Design
2. Understanding of Business Strategy
3. Knowledge of the Product
4. Knowledge of the Application
5. Knowledge of Industry Trends
6. Ease of Understanding Product Documentation
7. Communication Ability
8. Application-System Development Methodology
9. Businessman-Engineer Morality
10. Total Satisfaction

<b>Questions:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Weighted Averages:</b>										
<b>Total</b>	<b>6.2</b>	<b>5.1</b>	<b>6.0</b>	<b>6.1</b>	<b>4.8</b>	<b>5.5</b>	<b>6.4</b>	<b>6.5</b>	<b>7.1</b>	<b>6.3</b>
<b>Japan</b>	<b>6.0</b>	<b>4.7</b>	<b>5.7</b>	<b>5.9</b>	<b>4.6</b>	<b>5.1</b>	<b>5.9</b>	<b>6.2</b>	<b>6.7</b>	<b>6.0</b>
<b>U.S.</b>	<b>6.3</b>	<b>5.5</b>	<b>6.3</b>	<b>6.2</b>	<b>4.9</b>	<b>5.8</b>	<b>6.8</b>	<b>6.9</b>	<b>7.6</b>	<b>6.6</b>
<b>User Base:</b>										
<b>Fujitsu</b>	<b>6.1</b>	<b>4.8</b>	<b>5.6</b>	<b>5.8</b>	<b>4.4</b>	<b>5.4</b>	<b>6.0</b>	<b>6.2</b>	<b>6.8</b>	<b>6.0</b>
<b>IBM</b>	<b>6.2</b>	<b>5.4</b>	<b>6.1</b>	<b>6.1</b>	<b>4.7</b>	<b>5.8</b>	<b>6.8</b>	<b>6.8</b>	<b>7.7</b>	<b>6.5</b>
<b>NEC</b>	<b>6.0</b>	<b>4.5</b>	<b>6.0</b>	<b>6.1</b>	<b>4.9</b>	<b>5.0</b>	<b>5.9</b>	<b>6.3</b>	<b>6.4</b>	<b>6.1</b>
<b>Hitachi</b>	<b>6.5</b>	<b>7.5</b>	<b>7.0</b>	<b>6.0</b>	<b>5.5</b>	<b>4.0</b>	<b>5.0</b>	<b>4.5</b>	<b>5.0</b>	<b>5.5</b>
<b>Unisys/Burroughs</b>	<b>7.0</b>	<b>6.4</b>	<b>7.8</b>	<b>7.2</b>	<b>6.4</b>	<b>6.8</b>	<b>7.6</b>	<b>7.8</b>	<b>8.0</b>	<b>7.4</b>
<b>Unisys/Sperry</b>	<b>7.0</b>	<b>7.0</b>	<b>8.0</b>	<b>7.0</b>	<b>6.0</b>	<b>4.5</b>	<b>7.0</b>	<b>6.5</b>	<b>6.5</b>	<b>7.0</b>
<b>NCR</b>	<b>6.8</b>	<b>6.0</b>	<b>6.8</b>	<b>7.0</b>	<b>5.3</b>	<b>6.8</b>	<b>6.8</b>	<b>7.3</b>	<b>7.3</b>	<b>6.8</b>
<b>Mitsubishi</b>	<b>5.7</b>	<b>3.6</b>	<b>5.2</b>	<b>6.6</b>	<b>4.0</b>	<b>4.2</b>	<b>6.0</b>	<b>6.3</b>	<b>7.1</b>	<b>6.1</b>
<b>Toshiba</b>	<b>5.2</b>	<b>4.3</b>	<b>5.6</b>	<b>5.6</b>	<b>4.5</b>	<b>5.4</b>	<b>6.4</b>	<b>6.6</b>	<b>7.8</b>	<b>5.9</b>

**Table C.11: SOFTWARE PERSONNEL SUFFICIENCY(%)<sup>21</sup>**

Unit: Percent of Responses in Each Category

	<u>Surplus</u>	<u>Sufficient</u>	<u>Somewhat Short</u>	<u>Severe Shortage</u>	<u>No. of Responses</u>
<b>System Planning</b>	0.3	26.5	45.9	27.3	1346
<b>System Design</b>	0.2	15.7	47.2	36.9	1393
<b>Programming</b>	1.0	17.5	53.2	28.3	1400
<b>Operations Management</b>	3.5	56.8	32.8	6.9	1325
<b>Training &amp; Education</b>	--	20.0	42.4	37.6	800
<b>System Audit</b>	--	17.1	25.9	57.0	627

**Table C.12: SYSTEM SE SERVICE UTILIZATION RATES(%)<sup>22</sup>**

	<u>Computer Makers</u>	<u>Dealers</u>	<u>Software Houses</u>	<u>Consulting Companies</u>	<u>Other</u>	<u>No Response</u>
<b>Weighted Averages:</b>						
<b>Total</b>	<b>72.4</b>	<b>14.0</b>	<b>5.3</b>	<b>0.4</b>	<b>2.7</b>	<b>5.2</b>
<b>Japan</b>	<b>68.3</b>	<b>18.5</b>	<b>5.5</b>	<b>0.6</b>	<b>2.9</b>	<b>4.5</b>
<b>U.S.</b>	<b>87.7</b>	<b>7.0</b>	<b>4.4</b>	<b>1.0</b>	<b>0.8</b>	<b>3.6</b>
<b>Large Computers</b>	<b>80.8</b>	<b>8.4</b>	<b>4.1</b>	<b>0.3</b>	<b>2.4</b>	<b>4.1</b>
<b>Office Computers</b>	<b>48.1</b>	<b>32.3</b>	<b>9.4</b>	<b>0.5</b>	<b>3.2</b>	<b>6.5</b>
<b>User Base:</b>						
<b>Fujitsu</b>	<b>56.7</b>	<b>29.6</b>	<b>5.4</b>	<b>--</b>	<b>3.2</b>	<b>5.1</b>
<b>IBM</b>	<b>83.9</b>	<b>7.0</b>	<b>4.0</b>	<b>1.0</b>	<b>0.6</b>	<b>3.4</b>
<b>Hitachi</b>	<b>85.1</b>	<b>5.0</b>	<b>2.3</b>	<b>0.9</b>	<b>3.6</b>	<b>3.2</b>
<b>NEC</b>	<b>77.2</b>	<b>8.3</b>	<b>7.3</b>	<b>0.3</b>	<b>2.0</b>	<b>4.8</b>
<b>U/Sperry</b>	<b>95.5</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>4.5</b>
<b>U/Burroughs</b>	<b>97.4</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>2.6</b>
<b>NCR</b>	<b>84.6</b>	<b>--</b>	<b>7.7</b>	<b>--</b>	<b>2.6</b>	<b>5.1</b>
<b>Mitsubishi</b>	<b>37.9</b>	<b>44.8</b>	<b>13.8</b>	<b>--</b>	<b>--</b>	<b>3.4</b>

**Table C.13: USE OF OUTSIDE SERVICE IN APPLICATIONS<sup>23</sup>**

Unit: % of Service (Man-Months) Provided by Manufacturer

	System Planning	System Design	Programming	Maintenance
<b>% Using Outside Service:</b>				
Yes	25.5	39.8	50.8	28.3
No	68.6	55.1	44.6	65.5
No Response	5.7	5.2	4.7	6.2
<b>Major Source of Outside Service:</b>				
Computer Makers	50.2	37.4	19.7	24.3
Software Houses	21.1	41.8	57.3	46.1
Dealers	11.1	10.5	9.6	11.0
Consultants	7.8	2.0	0.5	0.2
Computer Centers	5.4	6.8	7.9	9.5
Other/No Answer	4.1	4.5	5.0	8.8



**Table C.14: APPLICATIONS SE SERVICE SATISFACTION BY SOURCE<sup>24</sup>**

Unit: 10-Point Scale

**Questions:**

1. Proposals for System Planning and Design
2. Understanding of Business Strategy
3. Knowledge of the Product
4. Knowledge of the Application
5. Knowledge of Industry Trends
6. Ease of Understanding Product Documentation
7. Communication Ability
8. Application-System Development Methodology
9. Businessman-Engineer Morality
10. Total Satisfaction

<b>Questions:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>Average</b>	6.5	5.4	6.6	6.3	5.3	6.2	6.6	6.8	7.2	6.6
<b>Computer Makers</b>	6.5	5.4	6.7	6.3	5.4	6.4	6.7	6.9	7.2	6.6
<b>Dealers</b>	5.9	4.4	6.2	6.2	4.6	5.4	6.3	6.2	6.8	6.0
<b>Software Houses</b>	5.9	4.7	5.8	6.0	4.8	6.2	6.5	6.6	7.0	6.3
<b>Computing Centers</b>	5.9	4.9	5.8	6.3	5.2	5.7	6.6	6.2	7.1	6.4
<b>Consulting Companies</b>	8.0	7.5	7.1	7.2	5.6	7.0	7.8	8.2	8.2	7.7
<b>Other</b>	6.0	4.8	5.3	5.0	5.5	5.5	6.5	6.5	6.2	5.8

## REFERENCES

1. This section relies on data from two issues of Nikkei Computer. The first, published on 26 September 1988, pp. 66-99, was a survey of general-purpose mainframe users and is based on questionnaires sent to 14,407 sites in Japan--excluding in-house departments of the computer manufacturers. Responses came from 5,422 sites, for a response rate of 37.6%. Excluding unclear answers, the effective responses were 5,226. Weighted averages for the were calculated on the basis of the unit shares of the sample, which are also used to estimate placement market shares by unit (see Table 1). The second Nikkei Computer survey, published in the 14 March 1988 issue, pp. 58-86, focuses on system engineering (SE) services for general-purpose and office computers, provided mainly by the computer manufacturers but also by dealers, software houses, consultants, and other sources. Surveys were sent to the information systems departments of 6000 large firms, including those listed in the first and second sections of the Tokyo Stock Exchange, and 448 non-listed companies with annual sales over 50 billion yen. Responses came back from 1589 companies, a rate of 26.5%. Including multiple responses from one company, there were 1600 effective responses. Approximately 91% of Japanese customers reported themselves as using machines from one vendor only in the categories in the survey, and only 5.6% claimed to be multi-vendor users. The remainder of the responses were unclear. Weighted averages were calculated from the survey responses as follows (p. 85):

### USER RESPONSES BY INDUSTRY

1600	Total
124	Materials Manufacturing
165	Machinery and Equipment Manufacturing
490	Other Manufacturing
166	Distribution
259	Finance
258	Service
14	Government and Education
109	Other
15	No Response

### USER RESPONSES BY COMPUTER MAKER

	<u>Total</u>	<u>Large Computers</u>	<u>Office Computers</u>	<u>Unclear</u>
Total	1600	1193	371	3
Fujitsu	467	362	105	0
IBM	298	171	126	1
NEC	289	240	47	2
Hitachi	221	206	211	4
U/Burroughs	76	69	7	0
U/Sperry	67	61	6	0

NCR	39	32	7	0
Mitsubishi	29	12	17	0
Toshiba	15	2	13	0
Oki	4	0	4	0
Other Makers	22	6	15	1
Computer Centers	21	--	--	21
Unclear	52	32	13	7

2. This estimate is based on the survey of 1600 users reported in Nikkei Computer, 14 March 1988, p. 85.

3. Nikkei Computer, 26 September 1988, p. 67.

4. Description of U.S.-owned firms in Japan is from Takahashi Kenkichi et al., Konpyuta gyokai (The computer industry), Tokyo, Kyoikusha, 1985.

5. Nikkei Computer, 26 September 1988, p. 77.

6. Nikkei Computer, 26 September 1988, p. 95.

7. Nikkei Computer, 26 September 1988, pp. 79 and 96 (discount rates).

8. Nikkei Computer, 14 March 1988, p. 64.

9. See the data on responses from the March 1988 survey discussed in the first note for this section.

10. Wall Street Journal, 15 May1 1985, p. 36.

11. Nikkei Computer, 26 September 1988, p. 77.

12. Nikkei Computer, 26 September 1988, p. 78.

13. Nikkei Computer, 26 September 1988, p. 78.

14. Nikkei Computer, 26 September 1988, p. 96.

15. Nikkei Computer, 14 March 1988, p. 72.

16. Nikkei Computer, 14 March 1988, p. 72.

17. Nikkei Computer, 14 March 1988, p. 68.

18. Nikkei Computer, 14 March 1988, p. 68.

19. Nikkei Computer, 14 March 1988, p. 75.

20. Nikkei Computer, 14 March 1988, p. 75.

21. Nikkei Computer, 14 March 1988, p. 84
22. Nikkei Computer, 14 March 1988, p. 75
23. Nikkei Computer, 14 March 1988, p. 73.
24. Nikkei Computer, 14 March 1988, p. 74.

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